

CX11252 HSF_i Modem

**Host-Processed
V.92/V.90/K56flex™ Modem
Device Family for PCI-Bus
Desktop and Mobile
Applications
Data Sheet (Preliminary)**

Conexant Proprietary Information

Revision Notice

Revision	Date	Comments
C	5/17/2001	Rev. C release.
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A	12/7/2000	Initial release.

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Revision History

Changes Incorporated in Doc. No. 101309C

1. Figure 4-1. Replaced with correct dimension drawing.

Changes Incorporated in Doc. No. 101309B

2. Throughout: Deleted SmartDAA models and interface.
3. Section 1.1: Added V.92 and V.44 introductory text.
4. Table 1-1: Revised ordering information.
5. Section 1.2: Added V.92, V.44, and Caller ID features, and updated system compatibility.
6. Section 1.3.3: Added V.92 and V.44 information.
7. Section 2.5: Added section with modem-on-hold information.
8. Section 2.4: Added V.44 information.
9. Section 3.5, Crystal Specifications: Added.
10. Table 3-9: Added VPCI3V and VAUX limit.
11. Table 3-10: Added current and power requirements.
12. Section 4: Added.

1 Introduction

1.1 Overview

The Conexant™ CX11252 (HSF1) Host-Processed V.92/V.90/K56flex™ Modem supports V.92 and V.90 analog data modem operation with V.44 data compression and supports 14.4 kbps fax modem operation. In addition, the modem supports remote telephone answering machine (TAM), soft speakerphone, and PCI/Mini PCI Bus interface operation. The modem operates with PSTN telephone lines in the U.S./Japan/Canada and worldwide. Available models are listed Table 1-1.

The CX11252 alone supports an analog interface to an OEM-provided DAA (Figure 1-1). This configuration supports data/fax/telephone answering machine (TAM) and software speakerphone. Discrete input/output lines interface to off-hook relay control and ring detection circuits. This is the lowest-cost solution for operation in the U.S./Japan/Canada/China/South America/CTR21 (TBR21). The countries supported are defined by the OEM-provided DAA.

Optimized to provide the lowest-cost design in the price-sensitive modem markets, the CX11252 is ideally suited for host-processed PCI/Mini PCI Bus-based desktop or mobile applications such as motherboards, system boards, plug-in cards.

The CX11252 incorporates the following circuits internally to reduce the application board bill of material (BOM) cost:

- **An internal voltage regulator allows operation in +5 V PCI systems without requiring an external regulator.**
- **An internal power switching circuit detects and selects operation from one of three power sources: PCI +5 V, PCI +3.3 V, or Vaux +3.3 V, which may be available in different combinations to a modem from a PC. This allows a single modem configuration to be used with different PCI-based PC designs.**
- **An internal ringwake filter eliminates the need for an external diode/resistor/capacitor circuit.**

External pin strapping options can be used to select PCI ID from internal ROM eliminating the need for external EEPROM.

The CX11252 integrates all digital and analog circuits into a single VLSI (very large scale integration) die packaged in a 100-pin thin quad flat pack (TQFP). Internal digital circuits include PCI Bus interface logic, +5 V voltage regulator, PCI Bus power switching, ROM, RAM, control and status registers, general purpose input/output, internal ringwake filter, and codec interface (Figure 1-2). The analog codec circuit includes a differential transmit analog output, a single-ended receive analog input, and an analog modem speaker output. Modem data pump and controller functions, traditionally implemented in dedicated hardware, are processed in a Pentium MMX-compatible PC using host-signal processing modem software.

In V.92/V.90/K56flex data mode, the modem can receive data at speeds up to 56 kbps from a digitally connected V.92/V.90 or K56flex-compatible central site modem. A V.92/V.90/K56flex modem takes advantage of the PSTN which is primarily digital except for the client modem to central office local loop and are ideal for applications such as remote access to an Internet Service Provider (ISP), on-line service, or corporate site. In this mode, the modem can transmit data at speeds up to 48 kbps in V.92 or up to V.34 rates in V.90.

Data compression (V.44/V.42 bis/MNP 5) and error correction (V.42/MNP 2-4) modes are supported to maximize data throughput and data transfer integrity. V.44 is a more efficient data compression than V.42 bis that significantly increases downstream throughput thus reducing the download time for the types of files associated with Internet use, such as Web pages and other uncompressed graphics, image, audio, and document files. V.44 data compression can achieve compression rates of more than 25% over V.42bis. Typical compression ratio for V.44 on Web type data is approximately 6-1 resulting in overall effective data throughput rate up to 300 kbps for a 56-kbps connection. Non-error-correcting mode is also supported.

All models support remote audio recording and remote audio playback over the telephone line interface using A-Law, μ -Law, or linear coding at 8 or 7.2 kHz sample rate to support applications such as digital telephone answering machine (TAM).

Hardware-based position independent, full-duplex speakerphone (FDSP) is optionally supported.

Fax Group 3 send and receive rates are supported up to 14.4 kbps with T.30 protocol.

V.80 synchronous access mode supports host-controlled communication protocols, e. g., H.324 video conferencing.

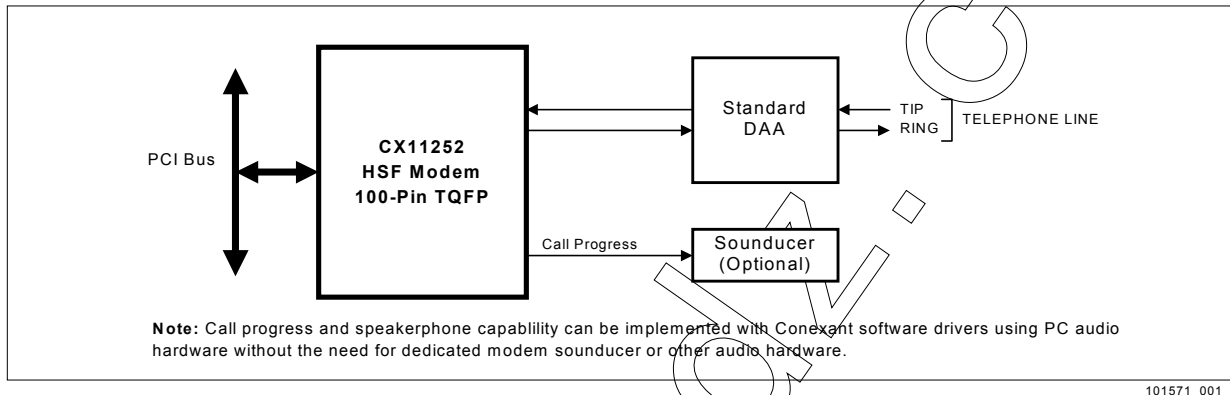
PCI and Mini-PCI reference design kits are available to minimize application design time and costs.

This data sheet describes the modem hardware capabilities. Commands and parameters are defined in the Commands Reference Manual (Order No. 100498).

Table 1-1. Modem Models and Functions

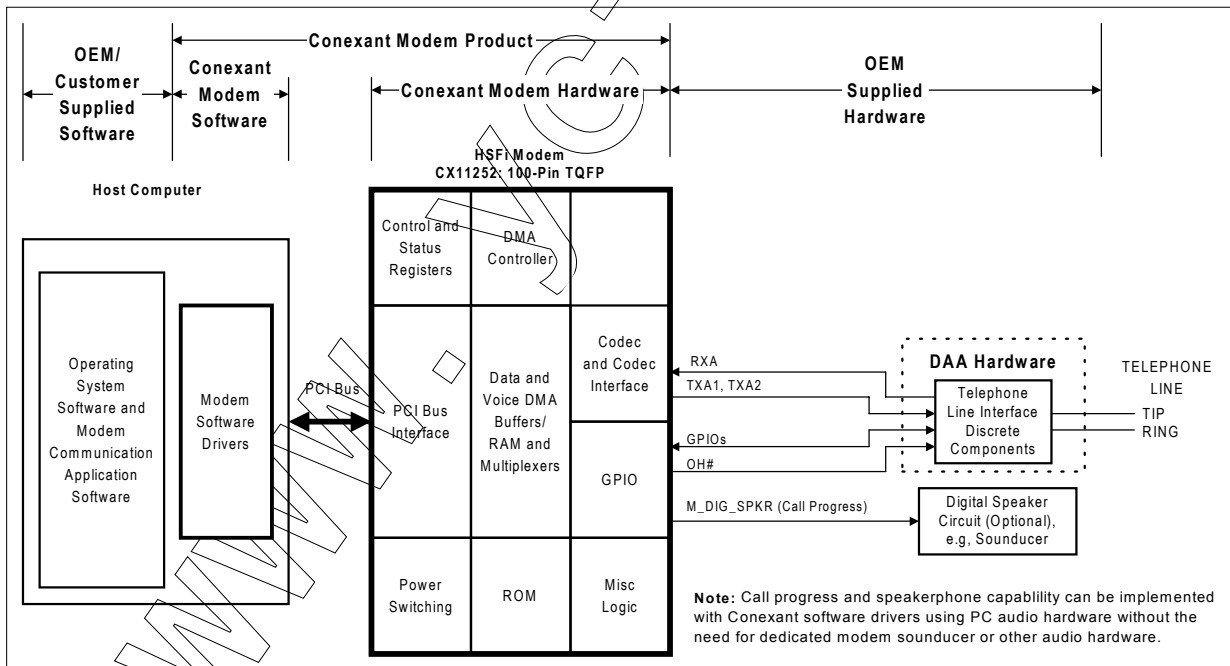
Model/Order/Part Numbers		Application/Supported Functions	
Device Set Order Number	Modem 100-Pin TQFP Part No.	Desktop or Mobile Application	V.92/V.90 Data, V.44 Data Compression, TAM, V.17 Fax, Software Speakerphone
CX11252-11	CX11252-11	Desktop	
DS56-L483-021	CX11252-11	Mobile	

Figure 1-1. CX11252 HSFi Modem Simplified Interface



101571_001

Figure 1-2. CX11252 HSFi Modem Major Interfaces



101571_002

1.2 Features

- Data modem with receive rates up to 56k bps and send rates up to 48 kbps (V.92 mode) or up to V.34 rates (V.90 mode)
 - V.92, V.90, K56flex, V.34, V.32 bis, V.32, V.22 bis, V.22, V.23, and V.21, Bell 212A and Bell 103 modulation modes
 - Quick connect
 - Modem-on-hold
 - V.250 and V.251 commands
- Data compression and error correction
 - V.44 data compression for optimal downloading of Internet Web pages and files
 - V.42 bis and MNP 5 data compression
 - V.42 LAPM and MNP 2-4 error correction
- Fax modem with send and receive rates up to 14.4 kbps
 - V.17, V.29, V.27 ter, and V.21 channel 2
 - EIA/TIA 578 Class 1 and T.31 Class 1.0 commands
- Caller ID detect
 - On-hook Caller ID detection
 - Off-hook Call Waiting Caller ID detection during data mode in V.92, V.90, V.34 V.32bis, or V.32
- Telephony/remote TAM
 - V.253 commands
 - 8-bit μ -Law/A-Law coding (G.711)
 - 8-bit/16-bit linear coding
 - 8 kHz sample rate
 - Concurrent DTMF detect, ring detect and caller ID detect
- V.80 synchronous access mode supports host-controlled communication protocols with H.324 interface support
- V.8/V.8bis and V.251 commands
- Data/Fax call discrimination
- Internal circuits eliminate external components
 - EEPROM
 - +5 V to +3.3V voltage regulator
 - PCI +5V, PCI +3.3V, and Vaux +3.3V power switching circuit
 - Ringwake eliminating external diode/resistor/capacitor circuit
- Worldwide operation including U.S./Japan/Canada
 - Complies to requirements of TBR21 and all other countries
 - Caller ID detection
 - Call progress, blacklisting

- Single configuration profile stored in host
- Modem and audio paths concurrent across PCI Bus
- System compatibility
 - Windows 95/98 operating system on an MMX 200 MHz-based computer with 32 MB RAM, or equivalent
 - Windows 98SE/ME/2000 operating system on a MMX 200 MHz-based computer with 64 MB RAM, or equivalent
 - Microsoft's PC 2001 Design Initiative compliant
 - Unimodem/V compliant
 - Linux Kernel 2.2.16, 2.2.17, and 2.4
- Operates from +5 V PCI, +3.3 V PCI, or +3.3 V Vaux
 - Automatic PCI +5 V, PCI +3.3 V, or Vaux internal power switching
 - +5 V operation or +3.3 V operation with +5 V tolerant digital inputs
- +3.3 V analog operation
- 32-bit PCI Local Bus interface
 - Compliant with PCI Local Bus Specification Rev. 2.2 and Mini PCI Specification Draft 1.0.
 - PCI Bus Mastering interface
 - 33 MHz PCI clock support
 - Meets PCI Bus Power Management Spec. Rev. 1.1
 - ACPI Power Management Registers
 - APM support
 - PME# support
- CX11252 packaged in small 100-pin TQFP

1.2.1

Applications

- PCI plug-in cards
- Embedded PC motherboards
- System boards

1.3 Technical Overview

1.3.1 General Description

The CX11252 provides the processing core for a complete modem system design featuring data/fax/remote TAM modem. Modem operation, including dialing, call progress, telephone line interface, and host interface functions, are supported and controlled through the command set.

Modem operation, including dialing, call progress, telephone line interface, telephone handset interface, voice/speakerphone interface, and host interface functions are supported and controlled through the V.250, V.251, and V.253-compatible command set.

The modem hardware connects to the host processor via a PCI or Mini PCI interface. The OEM adds a crystal circuit and standard DAA circuit to complete the system.

1.3.2 Host Modem Software

The host modem software performs the following tasks:

1. General modem control, which includes command sets, fax Class 1 and 1.0, remote TAM, voice/speakerphone, error correction, data compression, and operating system interface functions.
2. Modem data pump signal processing, which includes data and facsimile modulation and demodulation, as well as voice sample formatting.

Modem software is provided to support modem models listed in Table 1-1 (see Software Release Notices).

1.3.3 Operating Modes

Data/Fax Modes

V.92 data modem mode, the modem supports the following:

- Receive data from a digital source supporting V.92 over the digital telephone network portion of the PSTN at line speeds up to 56 kbps.
- PCM upstream which transmits data at line speeds from 24 kbps up to 48 kbps in increments of 1.33 kbps.
- Quick connect which allows quicker subsequent connection to a V.92 server using stored line parameters obtained during the initial connection.
- Modem-on-hold which allows detection and reporting of incoming phone calls on the PSTN with enabled Call Waiting. If the incoming call is accepted by the user, the user has a server pre-defined amount of time of holding the data connection for a brief conversation. The data connection resumes upon termination of the incoming call.
- V.92 mode can fallback to V.90 mode.

In V.90/K56flex data modem mode, the modem can receive data from a digital source using a V.90- or K56flex-compatible central site modem over the digital telephone network portion of the PSTN at line speeds up to 56 kbps. Asymmetrical data

transmission supports sending data at line speeds up to V.34 rates. This mode can fallback to full-duplex V.34 mode, and to slower rates as dictated by line conditions.

In V.34 data modem mode, the modem can operate in 2-wire, full-duplex, asynchronous modes at line rates up to 33.6 kbps. Data modem modes perform complete handshake and data rate negotiations. Using V.34 modulation to optimize modem configuration for line conditions, the modem can connect at the highest data rate that the channel can support from 33600 bps down to 2400 bps with automatic fallback. Automode operation in V.34 is provided in accordance with PN3320 and in V.32 bis in accordance with PN2330. All tone and pattern detection functions required by the applicable ITU or Bell standard are supported.

In fax modem mode, the modem can operate in 2-wire, half-duplex, synchronous modes and can support Group 3 facsimile send and receive speeds of 14400, 12000, 9600, 7200, 4800, and 2400 bps. Fax data transmission and reception performed by the modem are controlled and monitored through the fax EIA/TIA-578 Class 1 or T.31 Class 1.0 command interface. Full HDLC formatting, zero insertion/deletion, and CRC generation/checking are provided.

V.44 Data Compression

V.44 provides efficient data compression that decreases the download time for the types of files associated with Internet use. This significant improvement is most noticeable when browsing and searching the web since HTML text files are highly compressible. (The improved performance amount varies both with the actual format and with the content of individual pages and files.)

Synchronous Access Mode (SAM) - Video Conferencing

V.80 Synchronous Access Mode between the modem and the host/DTE is provided for host-controlled communication protocols, e.g., H.324 video conferencing applications.

Voice-call-first (VCF) before switching to a videophone call is also supported.

Internal Switching Circuit

An internal power switching circuit detects and selects operation from one of three power sources: PCI +5 V, PCI +3.3 V, or Vaux +3.3 V, which may be available in different combinations to a modem from a PC in the retail and OEM markets. The combinations supported are:

PCI +3.3 V	PCI +5 V	Vaux +3.3 V	Device Power Source
0	0	0	0
0	0	1	Vaux +3.3V
0	1	0	PCI +5V
0	1	1	PCI +5V in D0 or Vaux +3.3V in D3cold
1	0	0	PCI +3.3V
1	0	1	PCI +3.3V in D0 or Vaux +3.3V in D3cold
1	1	0	PCI +3.3V
1	1	1	PCI +3.3V in D0 or Vaux +3.3V in D3cold

TAM Mode

TAM Mode features include 8-bit μ -Law, A-Law, and linear coding at 8 kHz sample rate. Tone detection/generation, call discrimination, and concurrent DTMF detection are also supported. This mode supports applications such as digital TAM, voice annotation, and recording from and playback to the telephone line. ADPCM (4-bit IMA) coding is also supported to meet Microsoft WHQL logo requirements.

TAM Mode is supported by three submodes:

1. Online Voice Command Mode supports connection to the telephone line or a microphone/speaker.
2. Voice Receive Mode supports recording voice or audio data input, typically from the telephone line or a microphone.
3. Voice Transmit Mode supports playback of voice or audio data output, typically to the telephone line or a speaker.

Software Speakerphone

Software speakerphone may be accomplished through the system audio using audio drivers without the addition of dedicated microphone and speaker circuitry to reduce component cost.

1.3.4

Reference Design

PCI and Mini PCI Type IIIB reference designs are available to minimize application design time and costs.

These boards are pretested to pass FCC Part 15B, and Part 68 for immediate manufacturing.

A design package for each board is available in electronic form. The design package includes schematics, bill of materials (BOM), vendor parts list (VPL), board layout files in Gerber format, and complete documentation.

The designs can also be used for the basis of a custom designs by the OEM to accelerate design completion for rapid market entry.

1.4 Hardware Signal Interfaces

1.4.1 PCI Bus/Mini PCI Bus Host Interface

The PCI/Mini PCI interface connects directly to an embedded or external PCI/Mini PCI interface eliminating the need for additional external logic components.

The Bus Interface conforms to the PCI/Mini PCI Local Bus Specification, Production Version, Revision 2.2, December 18, 1998 and Mini PCI Specification Draft 1.0. It is a memory slave (burst transactions) and a bus master for PC host memory accesses (burst transactions). Configuration is by PCI configuration protocol.

The following interface signals are supported:

- Address and data
 - 32 bidirectional Address/Data (AD[31-0]); bidirectional
 - Four Bus Command and Byte Enable (CBE [3:0]), bidirectional
 - Bidirectional Parity (PAR); bidirectional
- Interface control
 - Cycle Frame (FRAME#); bidirectional
 - Initiator Ready (IRDY#); bidirectional
 - Target Ready (TRDY#); bidirectional
 - Stop (STOP#); bidirectional
 - Initialization Device Select (IDSEL); input
 - Device Select (DEVSEL#); bidirectional
- Arbitration
 - Request (REQ#); output
 - Grant (GRANT#); input
- Error reporting
 - Parity Error (PERR#); bidirectional
 - System Error; bidirectional
- System
 - Interrupt A (INTA#); output
 - Clock (PCICLK); input
 - Reset (PCIRST#); input
 - Clock Running (CLKRUN#); input
- Power Management
 - Power Management Event (PME#), output
 - Vaux Detect (VauxDET), input

1.4.2 Serial EEPROM Interface

A serial EEPROM may be used to store the Maximum Latency, Minimum Grant, Device ID, Vendor ID, Subsystem ID, and Subsystem Vendor ID parameters for the PCI Configuration Space Header. Contact an FAE the local Conexant sales office to determine if the EEPROM is required.

The serial EEPROM interface optionally connects to a Microchip 93LC66B (256 x 16), 93LC56B (128 x 16), Atmel AT93C66 (256 x 16), AT93C56 (128 x 16), or equivalent serial EEPROM. Its size can be reduced from the total of 4096 (256 x 16) bits down to 2048 (128 x 16) bits in non-PC card applications.

The EEPROM is programmable by the PC via the PCI Bus interface (see Section 4).

1.4.3 Telephone Line Interface

The CX11252 codec connects to the telephone line through a standard discrete DAA.

The following DAA interface signals are supported:

- A single-ended Receive Analog input (RXA) and a differential Transmit Analog output (TXA1 and TXA2) to the telephone line.
- An Off-hook (OH#) relay control output for connecting the modem to the telephone line.
- A Ring Indicate (IRING#) input for sensing a raw incoming ring signal.
- General purpose inputs/outputs (GPIOs)

1.4.4 Call Progress Digital Speaker Output

A digital speaker output (DSPKOUT) is provided which can be directed to a low-cost OEM-supplied speaker circuit for call progress in Data/Fax mode. Alternatively, call progress may be accomplished through the system audio using modem audio drivers in order to reduce component cost, in which case the digital speaker circuitry would not be needed.

2 Technical Specifications

2.1 Establishing Data Modem Connections

2.1.1 Dialing

DTMF Dialing. DTMF dialing using DTMF tone pairs is supported in accordance with ITU-T Q.23. The transmit tone level complies with Bell Publication 47001.

Pulse Dialing. Pulse dialing is supported in accordance with EIA/TIA-496-A.

Blind Dialing. The modem can blind dial in the absence of a dial tone if enabled by the X0, X1, or X3 command.

2.1.2 Modem Handshaking Protocol

If a tone is not detected within the time specified in the S7 register after the last digit is dialed, the modem aborts the call attempt.

2.1.3 Call Progress Tone Detection

Ringback, equipment busy, and progress tones can be detected in accordance with the applicable standard represented by the country profile currently in affect.

2.1.4 Answer Tone Detection

Answer tone can be detected over the frequency range of 2100 ± 40 Hz in ITU-T modes and 2225 ± 40 Hz in Bell modes.

2.1.5 Ring Detection

A ring signal can be detected from a TTL-compatible square wave input (frequency is country-dependent).

2.1.6 Billing Protection

When the modem goes off-hook to answer an incoming call, both transmission and reception of data are prevented for a period of time determined by country requirement to allow transmission of the billing signal.

2.1.7 Connection Speeds

Data modem line speed can be selected using the +MS command in accordance with V.250. The +MS command selects modulation, enables/disables automode, and selects transmit and receive minimum and maximum line speeds.

2.1.8 Automode

Automode detection can be enabled by the +MS command to allow the modem to connect to a remote modem in accordance with V.250.

2.2 Data Mode

Data mode exists when a telephone line connection has been established between modems and all handshaking has been completed.

2.2.1 Speed Buffering (Normal Mode)

Speed buffering allows a DTE to send data to, and receive data from, a modem at a speed different than the line speed. The modem supports speed buffering at all line speeds.

2.2.2 DTE-to-Modem Flow Control

If the modem-to-line speed is less than the DTE-to-modem speed, the modem supports XOFF/XON or RTS/CTS flow control with the DTE to ensure data integrity.

2.2.3 Escape Sequence Detection

The “+++” escape sequence can be used to return control to the command mode from the data mode. Escape sequence detection is disabled by an S2 Register value greater than 127.

2.2.4 GSTN Cleardown (V.92/V.90/K56flex, V.34, V.32 bis, V.32)

Upon receiving GSTN Cleardown from the remote modem in a non-error correcting mode, the modem cleanly terminates the call.

2.2.5 Fall Forward/Fallback (V.92/V.90/K56flex, V.34/V.32 bis/V.32)

During the initial handshake, the modem will connect at the appropriate speed to provide optimal modem throughput within V.92/V.90/K56flex/V.34/V.32 bis/V.32 mode depending upon signal quality and line conditions.

When connected in V.92/V.90/K56flex/V.34/V.32 bis/V.32 mode, the modem will fall forward or fallback to the optimal line speed within the current modulation depending upon signal quality.

2.2.6 Retrain

The modem may lose synchronization with the received line signal under poor line conditions. If this occurs, retrain is initiated to attempt recovery depending on the type of connection. Under such line conditions, retrain is also initiated after three consecutive renegotiations when the modem receives errors and retransmits data. If 30 seconds of retrain elapse without the modem connecting, the call will be terminated.

2.3 Modem-on-Hold

The modem-on-hold (MOH) function enables the modem to place a data call to the Internet on hold while using the same line to accept an incoming or place an outgoing voice call. This feature is available only with a connection to a V.92 server and can be executed through two methods.

One method is to enable MOH through the +PMH command. With Call Waiting Detection (+PCW command) enabled, an incoming call can be detected while on-line. Using a string of commands, the modem negotiates with the server to place the data connection on hold while the line is released so that it can be used to conduct a voice call. Once the voice call is completed, the modem can quickly renegotiate with the server back to the original data call.

An alternative method is to use communications software that makes use of the Conexant modem-on-hold drivers. Using this method, the software can detect an incoming call, place the data connection on hold, and switch back to a data connection.

2.4 Error Correction and Data Compression

V.44 Data Compression

V.44 data compression encodes pages and files associated with Web pages more efficiently than V.42 bis. These files include WEB pages, graphics and image files, and document files. V.44 can provide an effective data throughput rate up to DTE rate for a 56-kbps connection. The improved performance amount varies both with the actual format and with the content of individual pages and files.

V.44 data compression is controlled by the +DS44 extended-format compound parameter which accepts the following subparameters:

- **Direction:** Specifies the desired direction(s) of operation of the data compression function (from the DTE point of view).
- **Compression_negotiation:** Specifies whether or not the modem should continue to operate if the desired result is not obtained.
- **Capability:** Specifies the use of stream method, packet method, or multi-packet method.
- **Max_codewords_tx:** Specifies the maximum number of codewords which should be negotiated in the transmit direction.
- **Max_codewords_rx:** Specifies the maximum number of codewords which should be negotiated in the receive direction.
- **Max_string_tx:** Specifies the maximum string length to be negotiated in the transmit direction.

- Max_string_rx: Specifies the maximum string length to be negotiated in the receive direction.
- Max_history_tx: Specifies the maximum size of the history buffer to be negotiated in the transmit direction.
- Max_history_rx: Specifies the maximum size of the history buffer to be negotiated in the receive direction.

V.42 Error Correction

V.42 supports two methods of error correction: LAPM and, as a fallback, MNP 4. The modem provides a detection and negotiation technique for determining and establishing the best method of error correction between two modems.

MNP 2-4 Error Correction

MNP 2-4 is a data link protocol that uses error correction algorithms to ensure data integrity. Supporting stream mode, the modem sends data frames in varying lengths depending on the amount of time between characters coming from the DTE.

V.42 bis Data Compression

V.42 bis data compression mode operates when a LAPM or MNP connection is established.

The V.42 bis data compression employs a “string learning” algorithm in which a string of characters from the DTE is encoded as a fixed length codeword. Two dictionaries, dynamically updated during normal operation, are used to store the strings.

MNP 5 Data Compression

MNP 5 data compression mode operates during an MNP connection.

In MNP 5, the modem increases its throughput by compressing data into tokens before transmitting it to the remote modem, and by decompressing encoded received data before sending it to the DTE.

2.5

Fax Class 1 and Fax Class 1.0 Operation

Facsimile functions operate in response to Fax Class 1 commands when +FCLASS=1 or to Fax Class 1.0 commands when +FCLASS=1.0.

In the fax mode, the on-line behavior of the modem is different from the data (non-fax) mode. After dialing, modem operation is controlled by fax commands. Some AT commands are still valid but may operate differently than in data modem mode.

Calling tone is generated in accordance with T.30.

2.6

Voice/TAM Mode

Voice and audio functions are supported by the Voice Mode. Voice Mode includes three submodes: Online Voice Command Mode, Voice Receive Mode, and Voice Transmit Mode.

2.6.1 Online Voice Command Mode

This mode results from the connection to the telephone line or a voice/audio I/O device (e.g., microphone or speaker) through the use of the +FCLASS=8 and +VLS commands. After mode entry, AT commands can be entered without aborting the connection.

2.6.2 Voice Receive Mode

This mode is entered when the +VRX command is active in order to record from the telephone line.

Received analog voice samples are converted to digital form and compressed for reading by the host. AT commands control the codec sample rate.

Received analog mono audio samples are converted to digital form and formatted into 8-bit μ -Law, A Law, or linear format for reading by the host. AT commands control the bit length and sampling rate. Concurrent DTMF/tone detection is available.

2.6.3 Voice Transmit Mode

This mode is entered when the +VTX command is active in order to playback voice to the telephone line. Concurrent DTMF/tone detection is available. Digitized audio data is converted to analog form.

2.7 Caller ID

Both Type I Caller ID (On-Hook Caller ID) and Type II Caller ID (Call Waiting Caller ID) are supported. Both types of Caller ID are enabled/disabled using the +VCID command. Call Waiting Tone detection must be enabled using the +PCW command to detect and decode Call Waiting Caller ID. When enabled, caller ID information (date, time, caller code, and name) can be passed to the DTE in formatted or unformatted form. Inquiry support allows the current caller ID mode and mode capabilities of the modem to be retrieved from the modem.

Type II Caller ID (Call Waiting Caller ID) detection operates only during data mode in V.92, V.90, V.34, V.32bis, or V.32.

2.8 Multiple Country Support

Modem operation supports all countries. The following capabilities are provided in addition to the data modem functions previously described. Country dependent parameters are included in the .INF file for customization by the OEM Programmable Parameters.

The OEM supplies the DAA. Country support depends on the OEM-supplied DAA.

2.8.1 OEM Programmable Parameters

The following country-dependent parameters are programmable:

- Dial tone detection levels and frequency ranges.
- DTMF dialing transmit output level, DTMF signal duration, and DTMF interdigit interval parameters.
- Pulse dialing parameters such as make/break times, set/clear times, and dial codes.
- Ring detection frequency range.
- Blind dialing disable/enable.
- The maximum, minimum, and default carrier transmit level values.
- Calling tone, generated in accordance with V.25, may also be disabled.
- Call progress frequency and tone cadence for busy, ringback, congested, dial tone 1, and dial tone 2.
- Answer tone detection period.
- On-hook/off-hook, make/break, and set/clear relay control parameters.

2.8.2 Blacklist Parameters

The modem can operate in accordance with requirements of individual countries to prevent misuse of the network by limiting repeated calls to the same number when previous call attempts have failed. Call failure can be detected for reasons such as no dial tone, number busy, no answer, no ringback detected, voice (rather than modem) detected, and key abort (dial attempt aborted by user). Actions resulting from such failures can include specification of minimum inter-call delay, extended delay between calls, and maximum numbers of retries before the number is permanently forbidden ("blacklisted"). Up to 20 such numbers may be tabulated. The blacklist parameters are programmable. The current blacklisted and delayed numbers can be queried via AT*B and AT*D commands, respectively.

2.9 Diagnostics

2.9.1 Commanded Tests

Diagnostics are performed in response to the &T1 command per V.54:

- **Analog Loopback (&T1 Command).** Data from the local DTE is sent to the modem, which loops the data back to the local DTE.

Diagnostic testing with the Conexant ModemXpert Modem Diagnostic Program is supported.

2.10 Low Power Sleep Mode

When not being used, the modem assumes low power (D3) state.